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ITS ORIGIN, WATERS, AND MARINE LIFE

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CHAPTER XIV
ARTHROPODS: XIPHOSURA, PYCNOGONIDA,
AND CRUSTACEA

BIOLOGY OF COMMERCIAL SHRIMPS

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About 140 million pounds of shrimp were taken from the Gulf of Mexico in 1949. In the Gulf there are four commercially important shrimps: the common, white or lake shrimp, *Penaeus setiferus*; the grooved, Brazilian, pink and brown shrimp, *P. duorarum* and *P. aztecus*; and the seabob, *Xiphopenaeus kroyeri*. Of these, *P. setiferus*, during the middle 1930's, accounted for about 95 percent of the catch. At that time the fishery in the Gulf proper extended from St. Marks, Florida, with gaps, to Brownsville, Texas. Now, the fishery extends along almost the entire perimeter of the Gulf, and *P. aztecus* and *P. duorarum* have become progressively more important. Probably more than one-third of the 1949 catch was of these two species. Since we know more about *P. setiferus* the remarks that follow pertain to this species only and just for the northern Gulf of Mexico.

P. setiferus is most abundant in areas that are characterized by having an inland, brackish marsh connected by passes with an adjacent shallow offshore area of relatively high salinity and mud or clay bottom. The offshore characteristics seem to be required by the adults and probably also the larvae, while the inland marshes appear to be required by the post-larval pre-adults. The adults are rarely found in abundance in the Gulf of Mexico in depths greater than 30 fathoms. The pre-adults inhabit brackish water and at times are found in water that is almost fresh.

The females do not carry the eggs after fertilization but deposit them directly into the water. Some time prior to the emission of the eggs (time not known) the female has a spermatophore attached to her by the male. The eggs upon emission are fertilized by the sperm contained in the spermatophore. A female will lay about 500,000 eggs at each spawning, and it is probable that there is more than one spawning in a season.

As in other peneids, the first larval stage upon hatching from the egg begins as a nauplius. The

larval stages are represented by at least five naupliar, three protozoecal and two mysis stages.

Most, if not all, spawning takes place at sea and not in the estuarine inland waters. Either during or shortly after the larval stages the young shrimp move from the waters of the Gulf to the estuarine waters. Growth is rapid in these estuarine waters. When the young are about 50 mm. in total length (from tip of rostrum to end of telson) they begin to appear in abundance on the estuarine commercial fishing grounds.

The young first appear in the estuarine fishing grounds in June or July, depending upon the area, and by August they have begun to make their appearance in the waters of the Gulf. Generally, in the estuarine waters there is a gradient in size of the shrimp, smaller shrimp occurring in those waters farther inland and larger shrimp in those waters nearest the Gulf. This gradient in size appears to be associated more closely with locality than with salinity.

As the young increase in size they gradually move toward the open waters of the Gulf (fig. 70). The movement of shrimp from the inland waters to the open waters of the Gulf is intensified by the decreasing water temperatures during the fall. As the waters warm in the spring the larger shrimp which are in the open waters of the Gulf mature rapidly and spawn. The smaller shrimp which have wintered in the estuarine waters or in Gulf waters close to shore grow and mature rapidly but spawn later.

Spawning occurs, and appears to be continuous, from at least the latter part of March through September. Apparently there are two major peaks of spawning success. The first peak can be attributed to April in Louisiana and generally June near Aransas Pass, Texas. Growth is rapid and the young from these spawnings produce the fall "run" of shrimp. The spring "run" of shrimp is produced by the second peak of spawning success which appears to result from

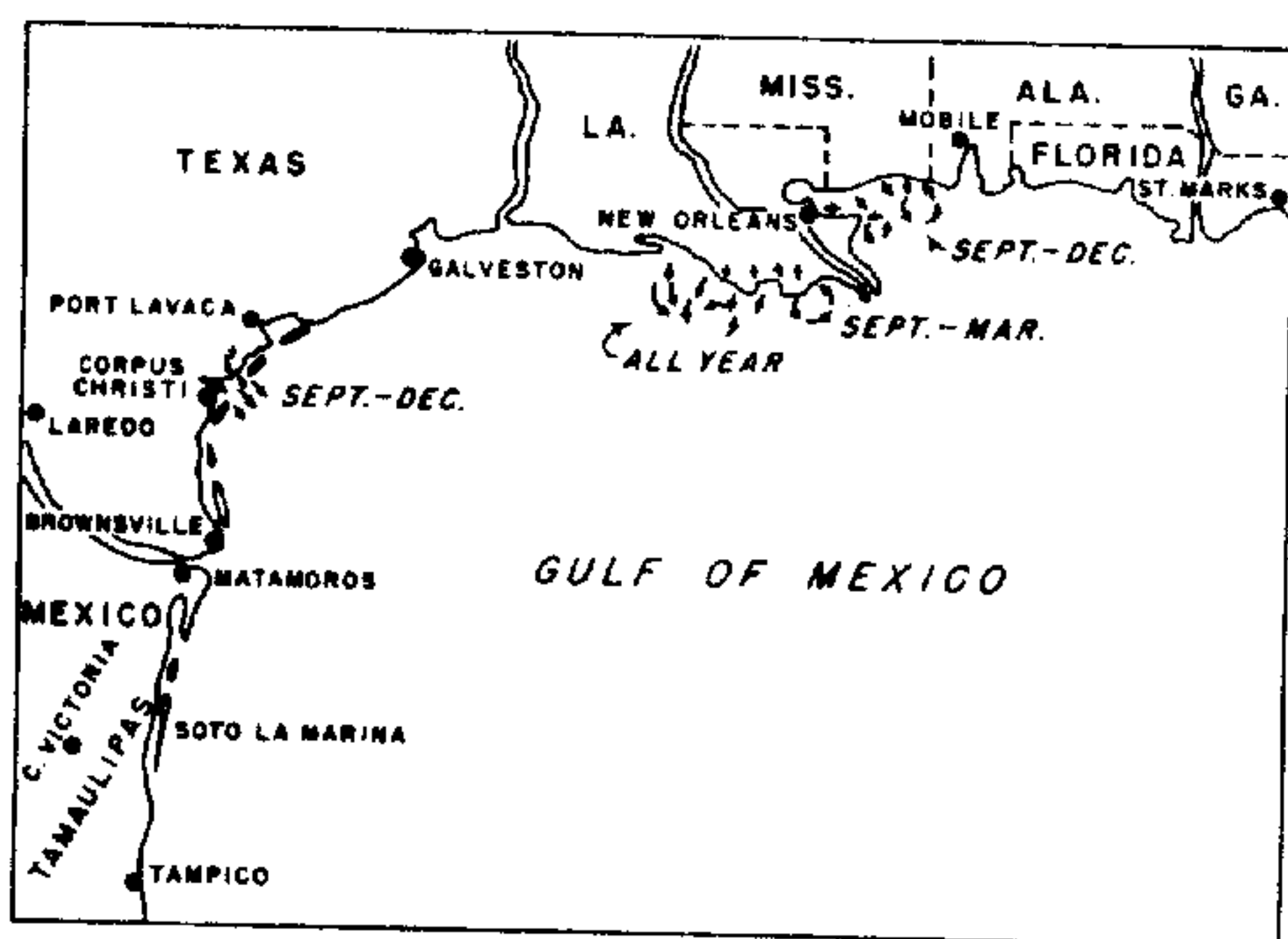


FIGURE 70.—Small shrimp (up to 13 cm.) movements of marked individuals.

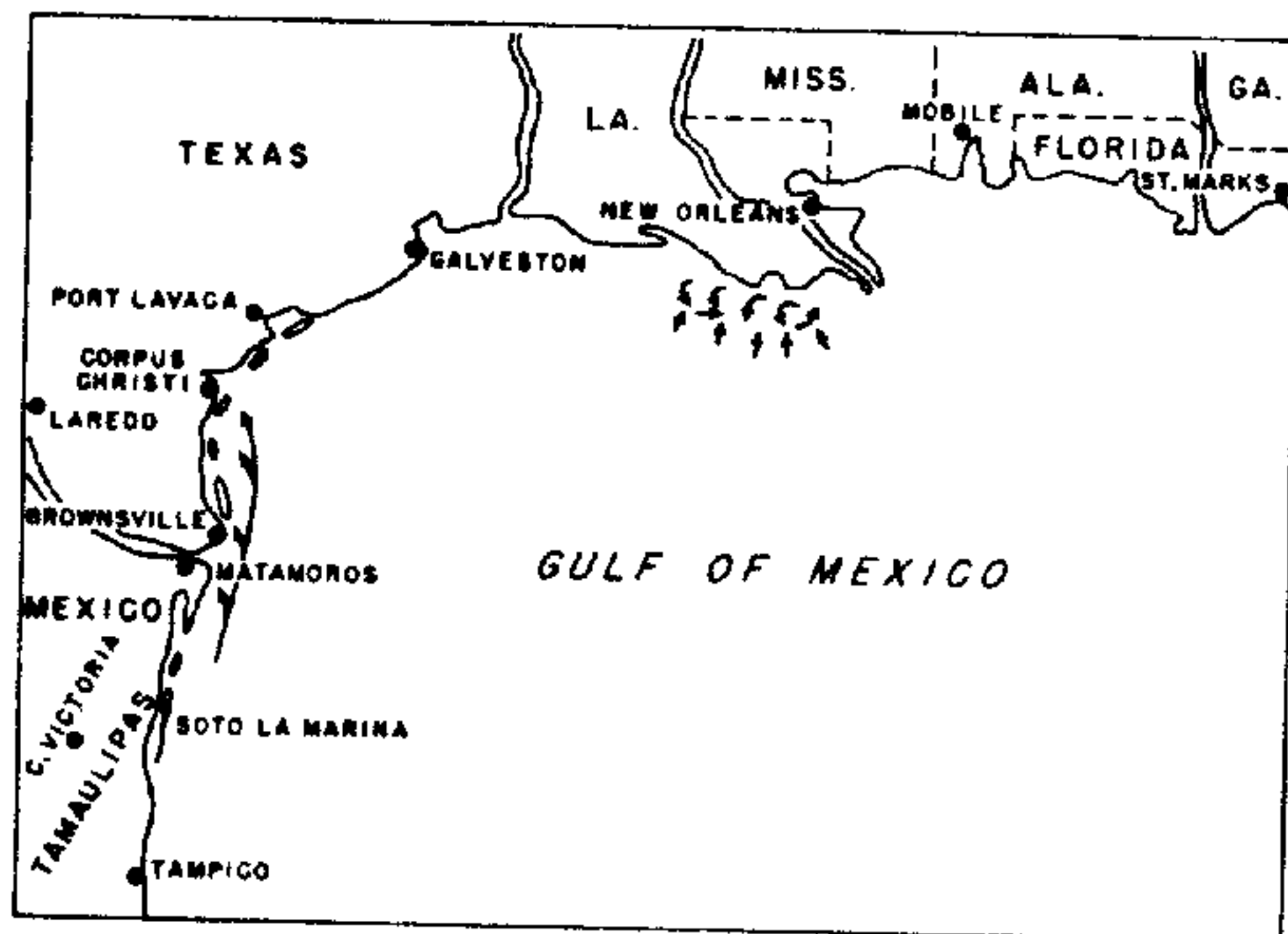


FIGURE 71.—Large shrimp (13 cm. and larger) spring movements of marked individuals.

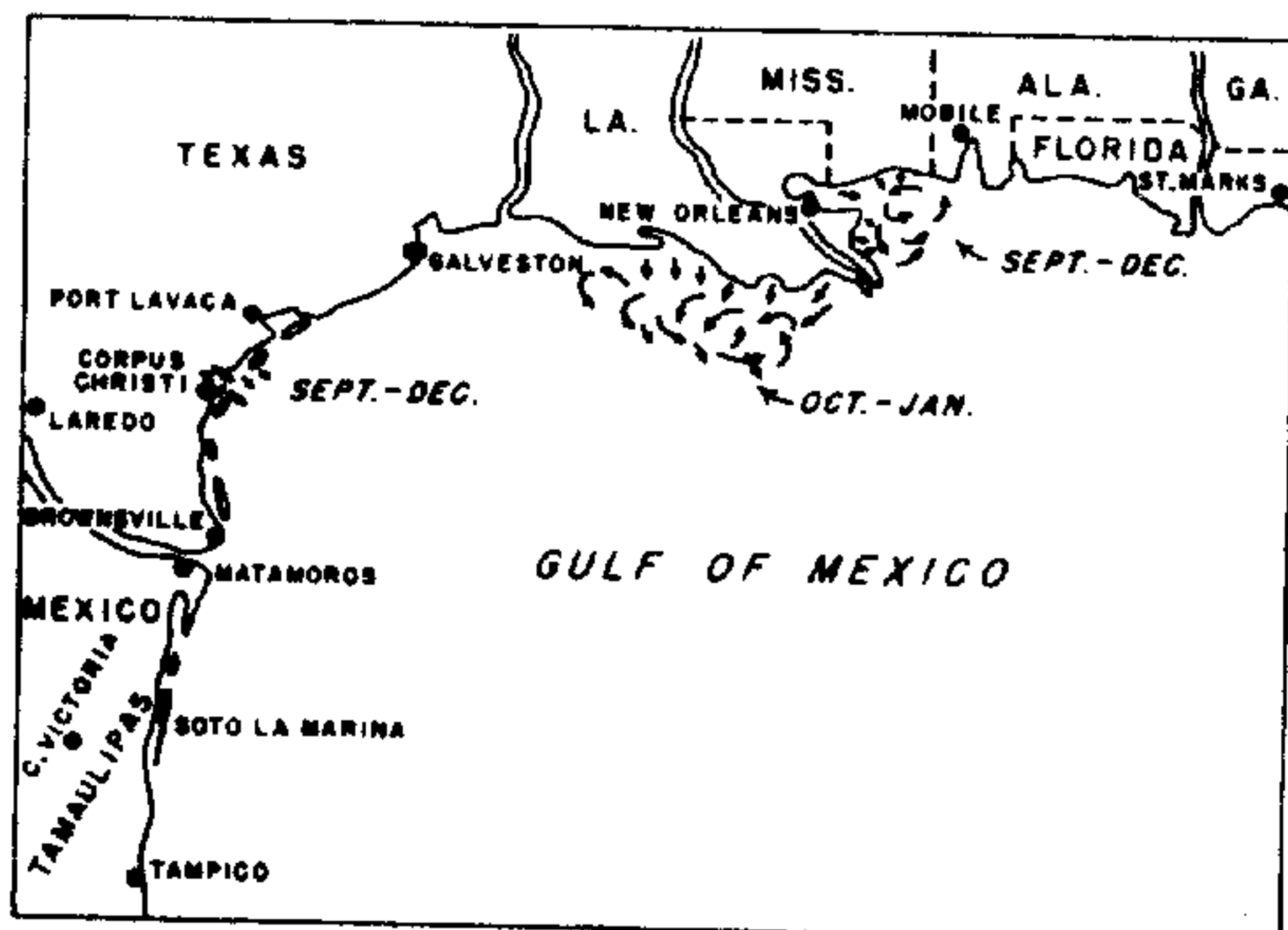


FIGURE 72.—Large shrimp (13 cm. and larger) fall and winter movements of marked individuals.

August or September spawning, both in Louisiana and in Central Texas. The shrimp from the first successful spawning have left the estuarine nursery grounds by midwinter. The young from the second successful spawning generally remain during winter in the estuarine waters and the immediately adjacent inner littoral waters.

The growth of the shrimp is quite rapid during the warm months of the year. From the time of hatching until they reach a length of about 120 mm. the shrimp apparently increase at a rate that averages more than a millimeter each day. This rapid rate continues until about the end of October when growth stops or almost stops, apparently as a result of temperature changes. From about the end of October until the end of February or of March, depending upon the locality, there is little or no growth. In the spring, as the water temperature increases, the shrimp again resume their rapid growth.

From central Texas south there is a definite possibility of migration. In the spring, based upon specimens marked in Mexico, there is a northward movement of shrimp. By inference, and from the time of the first successful spawning, but not based upon marked specimens, it appears highly probable that shrimp from the central and southern part of Texas may move south to the coast of Mexico during the fall and early winter, probably comparable to the movement along the South Atlantic coast of the United States.

In the northern portion of the Gulf of Mexico the wanderings of the shrimp can better be described as movements rather than as migrations (figs. 71, 72). The young gradually move from the estuarine waters to those of the Gulf. Once in the Gulf they appear to mill about like grazing cattle. However, as the temperatures drop during winter the shrimp tend to move a little farther offshore, and as the waters warm in the spring they tend to move back closer toward shore.

The movements of the shrimp are associated with spawning and with temperature. The normal spawning movement is offshore. During winter, in some localities, the movement becomes coast-wise because of temperature gradients. Along the northern part of the Gulf of Mexico, warmer winter waters which the shrimp seek are generally found in a belt between the 5- and 30-fathom lines.

In this section of the Gulf, because of the east-west direction of the coast line, there is no appreciable coastwise gradient in temperature. There is, nevertheless, a slight offshore gradient and apparently the shrimp take advantage of this gradient.

Along the western side of the Gulf there is a southward temperature gradient during the winter, and it is probable that there is a southward movement of shrimp from central and southern Texas into Mexico during this season.

The mortality rate is high and although some undoubtedly survive into their second year, for all practical purposes the shrimp can be considered an annual.

In order to manage the shrimp supply properly we must have considerably more knowledge than we have at present. We must know more about the relationship between the abundance of shrimp and their food supply; the effect of thinning or not thinning the population on the nursery grounds; the natural and fishing mortality rates, and the possible competitive action between the white and the grooved shrimps. In addition to these, there is a considerable gap in our knowledge between the time the eggs are laid until the shrimp appear on the nursery grounds. Our present information on this phase of the life history of the shrimp is indeed sketchy. What, for example, causes the apparent peaks in spawning success and what is their significance with respect to the management of this resource? The story of the shrimp is by no means a closed book. Our information has now arrived at the stage where approaches can be made to many important practical problems affecting the relationship between man, the environment, and the shrimp.

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